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Distribution and Population Constitution of *Drosophila* in South East Asia and Oceania

I. *Drosophilidae* at Mt. Kinabalu, East Malaysia¹⁾

By

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(With 52 Text-figures)

Collecting trips in twice were made in South East Asia (Malaysia, Indonesia, Thailand and Taiwan) from June to August in 1972 and from December in 1972 to February in 1973 to explore the drosophilid flies.

This is the first report of the *Drosophila* species sampled from one of the collecting localities, the Kinabalu National Park (about 800 square kilometers), Sabah, Malaysia.

A total of 1972 specimens were collected by net sweeping and exporsing fermenting banana baits in primeval forest near the National Park Headquarters Office from June 26 to 29 and from December 11 to 14 in 1972. They represent 28 species (including 17 new species) belonging to five genera, and several unknown species which are still examined.

Several collecting places are situated between 1500 meters and 1800 meters elevation in the mountain forest. Trees are smaller and ground cover is much denser, because more light reaches the ground. The light and increased moisture from low clouds leads to an abundance of epiphytes, such as orchids and mosses, growing on the trunks and branches of trees. Species composition is almost wholly different from lowland forest, and here consists of red lauan, oaks, mulberry, laurels, myrtles, etc. Many of these are representative of temperate families, the tropical groups are less evident. The Park Headquarters Office (1590 meters from sea-level) is located within this zone, on the southern boundary of the Kinabalu National Park and lies about 165 kilometers from Kota Kinabalu.

The authors wish to express their sincere thanks to Mr. A. J. Pereira, Executive Officer, Kinabalu National Park, Kota Kinabalu, Sabah, Malaysia, for giving

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many facilities for the present study.

All type specimens are deposited at the Biological Laboratory, Sapporo University.

Subfamily STEGANINAE

Genus *Stegana* Meigen

Subgenus *Parastegana* Okada

Parastegana Okada, 1971: 91.

Type-species: *Stegana femorata* Duda, 1923: 33 (Taiwan).

Stegana (Parastegana) fleximediata Takada, Momma & Shima n. sp.

(Text-figs. 1-3)

Male & female. Body about 3.5 mm in length, reddish yellow. Arista with 6 branches above, one below, besides a large fork. Palpus dark yellow, crescent, with a few prominent setae. Anterior reclinate orbital bristle absent. Humerals one, long. Fore metatarsus with about 4 stout black spines on posterior surface, basally. Thoracic pleura glossy blackish brown. Abdominal tergites glossy black on 4th to 6th tergites.

Wings hyaline with large black patches on costal cell, alula, tip of submarginal cell and R3+4; anterior cross vein; and from R2+3 to M3+4 along posterior cross vein, vertically. R2+3 straight, M1 sinuated at middle. Costal-index about 1.7; 4V-index about 2.3; 5X-index about 0.6; Ac-index about 12.0 and C3-fringe on basal 3/4. Third costal section with about 4 thorn-like warts.

Periphallic organs: Genital arch dark brown with about 15 long bristles and numerous microtrichia. Anal plate slender with yellowish long hairs on under margin. Clasper large, quadrate, with a marginal sensilla.

Phallic organs: Aedeagus flask shaped. Anterior parameres large, slender, with 2 sensilla on subapically. Tip of anterior parameres pointed, dark brown. Holotype. Male, Silau Silau Trail, Mt. Kinabalu, June 27, 1972 (Takada). Allotype. Female, collected together with holotype.

Paratypes. 5 males, Silau Silau Trail, Mt. Kinabalu, June 28-29, 1972 (Momma & Takada).

Distribution. Mt. Kinabalu, Borneo.

Genus *Amiota* Loew

Subgenus *Phortica* Schiner

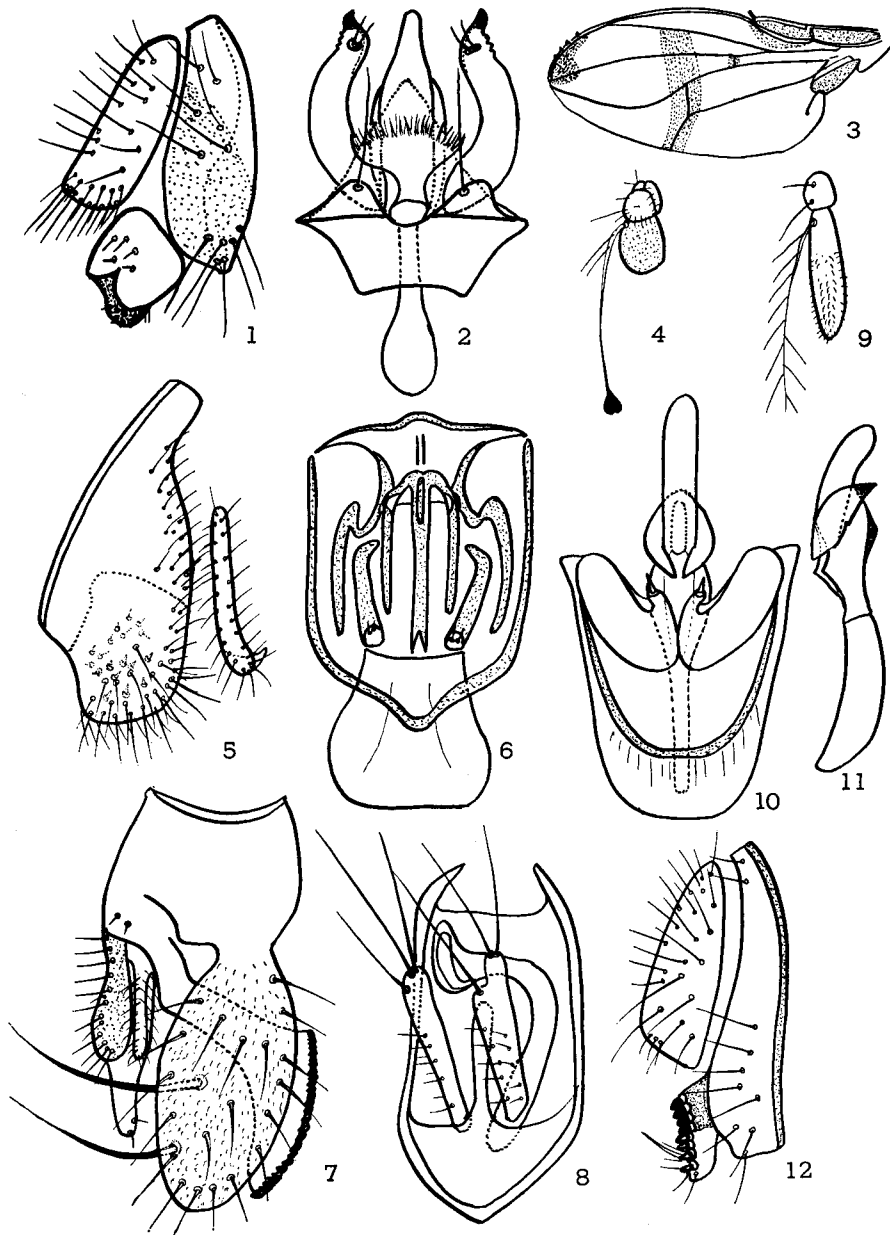
Phortica Schiner, 1862: 433.

Type-species, *Drosophila variegata* Fallén, 1823.

Amiota (Phortica) nigrifoliiseta Takada, Momma & Shima n. sp.

(Text-figs. 4-6)

Male. Body about 4.0 mm in length, yellow with dark greyish markings.



Figs. 1-3. *Stegana (Parastegana) fleximediata* n. sp., male genitalia and wing. Figs. 4-6. *Amiota (Phortica) nigrifoliiseta* n. sp., antenna with arista and male genitalia. Figs. 7-8. *Neotanygastrella sabahna* n. sp., male genitalia. Figs. 9-12. *Liodrosophila longiaristata* n. sp., antenna with arista and male genitalia.

Arista bare, apically with a leaf-like flap. Palpus black. Front velvety black. Cheeks narrow, white along eye margins. Mesonotum and scutellum black with irregular grey pollinose patches. Humerus white. Halter white. Abdomen yellow, 2nd to 4th tergites with posterior dark brown bands; 1st tergite with lateral spots.

Wings hyaline, R2+3 straight, R4+5 and M1 slightly convergent distally. Costal-index about 3.1; 4V-index about 3.0; 5x-index about 1.0; Ac-index about 3.0 and C3-fringe on basal 2/3. Third costal section without warts. Legs brownish yellow, fore femur with two dark annuli.

Periphallic organs: Genital arch fig shaped, large with numerous long bristles on ventral surface and many reddish hairs and spines on lower dorsal surface. Clasper absent. Anal plate slender.

Phallic organs: Aedeagus trident shaped, apically curved downwards and black. Anterior parameres slender, with a few sensilla basally.

Holotype. Male, Silau Silau Trail, Mt. Kinabalu, June 27, 1972 (Momma).

Paratype. Male, Mempening Trail, Mt. Kinabalu, June 28, 1972 (Takada).

Distribution. Mt. Kinabalu, Borneo.

Relationships. Closely related to *Amiota (Portica) foliiseta* Duda from Taiwan, in general features but differs in having palpi black, aedeagus tridentate shaped and without clasper.

Genus *Neotanygastrella* Duda

Neotanygastrella Duda, 1925. Mus, Nat. Hungarici, Ann., 22: 201.

Type-species: *Neotanygastrella tricoloripes* Duda, 1925 (Costa Rica).

Neotanygastrella sabahna Takada, Momma & Shima n. sp.

(Text-figs. 7-8)

Male & female. Body 2.4 mm in male and 3.6 mm in female, dark reddish brown. Arista with 5 branches above, 2 below, besides a fork. Second antenna black. Carina flat; oral bristle one. Front reddish brown, periorbits dark brown, orbital bristles in the ratio 3:1:5. Anterior reclinate orbital bristle small, placed slightly in front of and to the side of the proclinate orbital bristle; postverticals minute. Acrostichal hairs in 6 rows, humerals one; sterno-index about 0.3. Coxa white; fore femur, tibia and metatarsus dark brown. Abdominal tergites dark brown.

Wings hyaline, M3+4 dark brown in female. Costal-index about 2.0; 4V-index about 3.0; 5x-index about 2.5; Ac-index about 3.7 and C3-fringe on basal 4/5.

Periphallic organs: Genital arch broad, lower half elliptical protruded, covered with short hairs and microtrichia. Clasper elongated downward, boot shaped, primary teeth about 30 on marginal edges. Anal plate fused to genital arch anteriorly, consisting three parts; inner one pale with a few sensilla at under margin.

Phallic organs: Aedeagus yellow, apically broad and ventrally curved at distal half. Anterior parameres rod-like, apically with 3 long hairs and basal half with several sensilla. Ventral fragma V-shaped. Caudal margin of novasternum long and narrow.

Holotype. Male, Silau Silau Stream, Mt. Kinabalu, June 28, 1972 (Momma).

Allotype. Female, collected together with holotype.

Paratype. Male, collected together with holotype.

Distribution. Mt. Kinabalu, Borneo.

Relationships. Closely allied to *Neotanygastrella* species *b* Wheeler & Takada, 1964 from Caroline Is., Micronesia, especially in the shape of male genitalia, but differ from the latter in having different features of phallic organs.

Genus *Liodrosophila* Duda

Liodrosophila Duda, 1922: 153.

Type-species: *Camilla coeruleifrons* de Meijere, 1911: 421 (Java).

Liodrosophila longiaristata Takada, Momma & Shima n. sp.

(Text-figs. 9-12)

Male. Body about 2.5 mm in length, shining blackish brown. Third antennae long with pubescence, anterior half dark brown. Arista yellow and long, with 7 branches above and 2 below, besides a fork. Front metallic reddish brown. Acrostichal hairs in 2 rows only on anterior mesonotum. Humeral bristles minute. Halteres yellow. Abdominal tergites shining black. Coxa and femur reddish yellow. Tibia and tarsus yellow.

Wings hyaline, with a clouded spot on middle area including anterior cross vein; R2+3 straight, R4+5 convex at middle. Costal-index about 1.6; 4V-index about 3.0; 5x-index about 1.6; Ac-index about 4.0 and C3-fringe on basal 2/3.

Periphallial organs: Genital arch slender, brown; convex at undermargin. Anal plate fusiform, rear angle somewhat elongated below. Clasper elliptical, primary teeth about 4 black upper teeth and about 4 yellowish lower teeth arranged marginal line.

Phallic organs: Aedeagus pale brown, basal half bifid and elliptically swollen in ventral aspect; tip pointed to backward, apical half hyaline. Anterior parameres small, attached to novasternum, with a fine sesillum. Phallosomal index about 1.0.

Holotype. Male, Kiau View Trail, Mt. Kinabalu, June 27, 1972 (Takada).

Paratypes. 2 males, collected together with holotype.

Distribution. Mt. Kinabalu, Borneo.

Liodrosophila nitida Duda

Liodrosophila nitida Duda, 1922: 157 (Annam, Formosa); Duda, 1924: 241 (Formosa); Okada, 1966: 54 (Nepal).

Liodrosophila nitida var. *magnifrons* Duda, 1926: 53 (Sumatra); Okada, 1964: 440 (Borneo).

Specimens examined: 3 males and 4 females, Silau Silau Trail, June 28-29, 1972 (Takada).

Genus *Drosophila* Fallén

Subgenus *Sophophora* Sturtevant

Sophophora Sturtevant, 1939: 139.

Type-species: *Drosophila melanogaster* Meigen, 1830: 85 (Europe).

melanogaster group Sturtevant

melanogaster subgroup Hsu

Drosophila melanogaster Meigen

Drosophila melanogaster Meigen, 1830: 85. Type locality: Europe.

Specimens examined: 4 males and 6 females, Cabins of Headquarters, Mt. Kinabalu, June 27-29, 1972 (Takada).

Distribution. Worldwide.

ananassae subgroup Hsu

Drosophila ananassae Doleschall

Drosophila ananassae Doleschall, 1858, Nat. Tijd. Ned. Ind., 17: 128.

Type locality: Ambon Is., Indonesia.

Specimens examined: 12 males, Cabins of Headquarters, Mt. Kinabalu, June 27-29, 1972 (Takada).

Distribution. Worldwide, rare in Palaearctic and Nearctic regions.

takahasii subgroup Hsu

Drosophila paralutea Bock & Wheeler

Drosophila paralutea Bock & Wheeler, 1972. Univ. Tex. Publ. 7213: 15.

Type locality: Thailand.

Specimens examined: 3 males. Silau Silau Trail, June 28, 1972 (Takada).

Distribution. Thailand, Borneo (new record).

Drosophila trilutea Bock & Wheeler

Drosophila trilutea Bock & Wheeler, 1972. Univ. Tex. Publ. 7213: 17. Type locality: Taiwan.

Specimens examined: 4 males, Silau Silau Trail, June 27, 1972 (Takada).

Distribution. Taiwan, Borneo (new record).

montium subgroup Hsu

***Drosophila rhopaloa* Bock & Wheeler**

Drosophila rhopaloa Bock & Wheeler, 1972. Univ. Tex. Publ. 7213: 69. Type locality: Thailand.

Specimens examined: 2 males, Silau Silau Trail, Mt. Kinabalu, June 28, (Takada).

Distribution. Thailand, Borneo (new record).

***Drosophila parvula* Bock & Wheeler**

Drosophila parvula Bock & Wheeler, 1972. Univ. Tex. Publ. 7213: 73. Type locality: Malaya.

Specimens examined: 13 males, Silau Silau Trail, Mt. Kinabalu, June 27-29, and Dec. 11-14, 1972 (Momma, Takada & Shima).

***Drosophila cornixa* Takada, Momma & Shima n. sp.**

(Text-figs. 13-14)

Male. Body about 1.7 mm in length, amber. Arista with 6 branches above, 2 below, besides a terminal fork. Third antenna pubescence. Orbital bristles in the ratio 4:1:5. Acrostichal hairs in 6 rows. Sterno-index about 0.5. Sex-comb in transverse row of stout black bristles; one lower metatarsal row of 6 bristles (sometimes an additional bristle above this row); and 2 rows on the second tarsal segment of 2 bristles (upper row), and 5 bristles (lower row).

Wings hyaline, Costal-index about 1.8; 4V-index about 2.3 and 5x-index about 3.0: C3-fringe on basal 7/10.

Periphallic organs: Genital arch broad with slight constriction at mid-anterior margin. Primary clasper with 6 primary teeth and about 8 marginal bristles; inner surface with about 6 long bristles and with a thick tooth on posterior margin. Anal plate separated, anterior half sclerotized and concave medial margin. Secondary clasper with one very large black ventromedial tooth, a few hairs on anterior thumb like process.

Phallic organs: Aedeagus non-bifid, apically strongly hirsute. Anterior parameres large, glove shaped with 2 long sensilla and with a few microtricha. Posterior parameres thick and large, apically truncate, U-shaped.

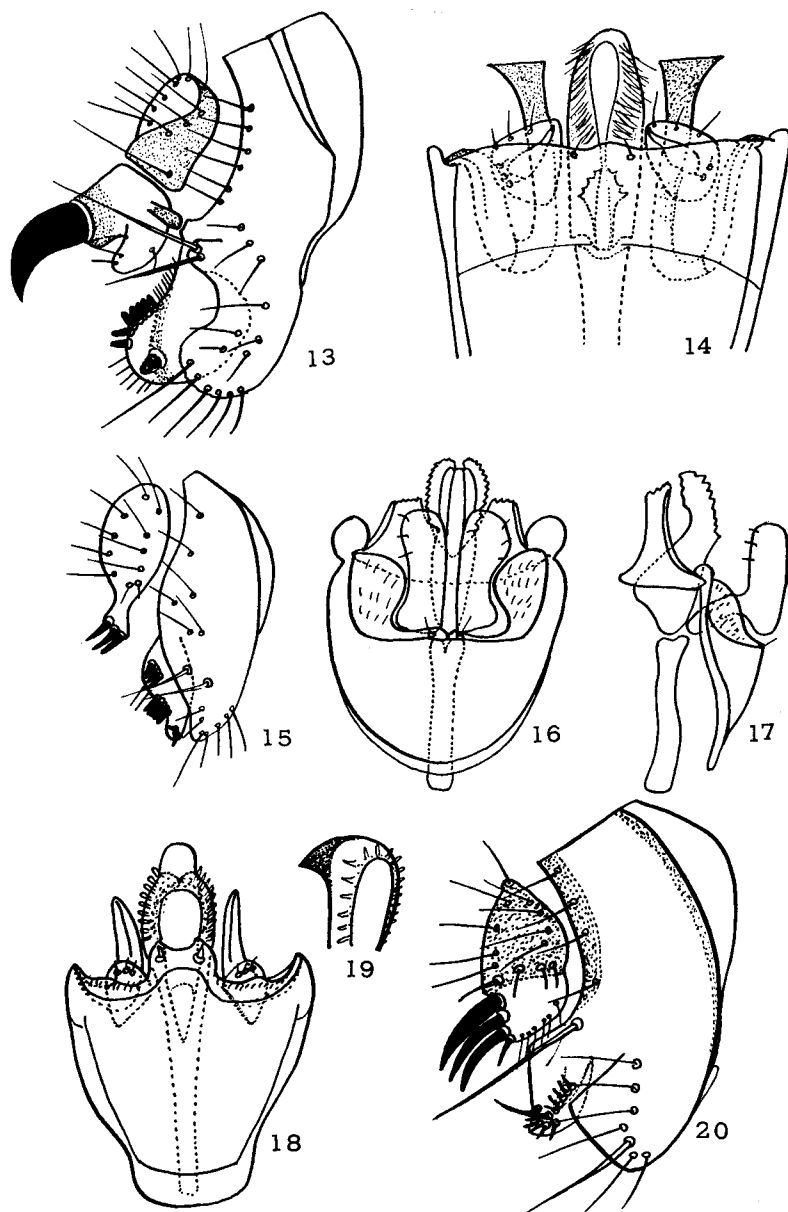
Holotype. Male, Silau Silau Trail, Mt. Kinabalu, June 28, 1972 (Takada).

Distribution. Mt. Kinabalu, Borneo.

***Drosophila exiguata* Takada, Momma & Shima n. sp.**

(Text-figs. 15-17)

Male. Small body about 1.3 mm, wings about 1.4 mm in length, reddish yellow. Arista with 6 branches above, 2 below, besides a fork. Orbital bristles



Figs. 13-14. *Drosophila (Sophophora) cornixa* n. sp., male genitalia. Figs. 15-17. *Drosophila (Sophophora) exiguatata* n. sp., male genitalia. Figs. 18-20. *Drosophila (Sophophora) kinabaluana* n. sp., male genitalia.

in the ratio 5:2:9. Acrostichal hairs in 6 rows. Sex-comb longitudinal on the metatarsus consisting about 10 long teeth.

Wings hyaline, Costal-index about 2.2; 4V-index about 3.0; 5x-index about 2.7; Ac-index about 2.5; C3-fringe on basal 2/5.

Periphallic organs: Sclerotization very weak. Genital arch yellow, crescent, broad at middle, heel absent and toe pointed. Anal plate oval, secondary clasper protruded, bearing one large tooth at tip, two large bristles under the large one. Primary clasper large, primary teeth two separate rows, upper one 4, lower one 5; marginal bristles also two sets, upper one 2, underneath the upper teeth row; lower one 2 spines, at the pointed tip.

Phallic organs: Aedeagus rod-like, broader basally, apically with notched and serrate. Anterior parameres large, with 3 apical sensilla, articulated to aedeagus. Posterior parameres large and broad, apically truncate and serrated, basally fused. Caudal margin of novasternum concave, with a pair of near separated spines. Phallosomal index about 1.0.

Holotype. Male, Liwagu Cave, Mt. Kinabalu, June 28, 1972 (Takada).

Paratypes. 4 males, collected together with holotype.

Distribution. Mt. Kinabalu, Borneo.

***Drosophila kinabaluana* Takada, Momma & Shima n. sp.**

(Text-figs. 18-20)

Male. Body about 2.0 mm in length, shining tannish yellow. Second orals about 3/4 of first ones. Arista with 4 branches above, 3 below, besides a fork. Orbital bristles in the ratio 5:2:6. Acrostichal hairs in 8 rows. Sterno-index about 0.4.

Wings hyaline, Costal-index about 2.4; 4V-index about 2.6; 5x-index about 2.7; Ac-index about 2.5; C3-fringe on basal 2/5. Sex-comb longitudinal along entire length of metatarsus and second tarsal segment; metatarsus comb consisting of about 18 black teeth, lower most 4 somewhat larger; comb of second tarsal segment consisting of about 10 black teeth which is equal in size.

Periphallic organs: Genital arch broad, heel broad and roundish, undermargin strongly convex; toe about same level as heel, covering base of clasper. Anal plate conical, secondary clasper contiguous to anal plate, with about 10 stout bristles, 3 marginal bristles exceedingly thick. Primary clasper conical, distally with a row of several pointed black teeth, and a cluster of teeth (one large elongated). Secondary clasper loosely contiguous to anal plate, oval, with 3 large curved black medial teeth and one short tooth and several small bristles ventrally and laterally.

Phallic organs: Aedeagus rod-like, apically pointed at backward (fig. 19), subapically with many ciliary process. Anterior parameres conical with a few sensilla. Posterior parameres large, divergent, apically rounded. Caudal margin of novasternum with median notched, and with short submedian spines. Phallo-

somal index about 1.2.

Holotype. Male, Kiau View Trail, Mt. Kinabalu, June 27, 1972 (Takada).

Paratypes. 8 males, collected together with holotype.

Distribution. Mt. Kinabalu, Borneo.

Relationships: Closely allied to *Drosophila truncata* Okada from Brunei, Borneo, especially in the shape of male genitalia, but distinguishable from the latter in having larger costal-index and smaller Ac-index; posterior parameres without serration and aedeagus with pointed process at dorsoapically.

***Drosophila longipectinata* Takada, Momma & Shima n. sp.**

(Text-figs. 21-23)

Male. Body about 2.5 mm in length, yellow. Arista with 4 branches above, 3 below, besides a fork. Third antennae snowy white. Face black. Pulpi with only one prominent bristle. Orbital bristles in the ratio 5:2:5. Acrostichal hairs in 8 rows. Sterno-index about 0.6. Abdominal tergites yellow, with posterior dark brown bands. Sex-comb longitudinal along entire lengths of long metatarsus and short second tarsal segment; metatarsal comb consisting of about 30 black teeth, lower most 2 larger; comb of second tarsal segment consisting of about 15 teeth.

Wings hyaline, first costal section with 2 stout subequal bristles; Costal-index about 2.2; 4V-index about 2.4; 5x-index about 2.0; Ac-index about 3.0; C3-fringe on basal 3/5.

Periphallic organs: Genital arch broad laterally, with median dorsal constriction, toe elongate, narrow, with about 10 lateral bristles. Primary clasper conical, primary teeth about 5, secondary teeth about 8, a ventromedial cluster of teeth (one large elongated). Secondary clasper with 4 very large curved black teeth and several small ventral and lateral bristles.

Phallic organs: Aedeagus slender, subapically and basally swollen, ventrally curved; apodeme of aedeagus slender and long. Anterior parameres rod-like, divergent, with 3 apical sensilla. Posterior parameres H-shaped. Basal branches large, with marginally serrated. Caudal margin of novasternum with shallow concavity and a pair of submedian spines. Phallosomal index about 0.6.

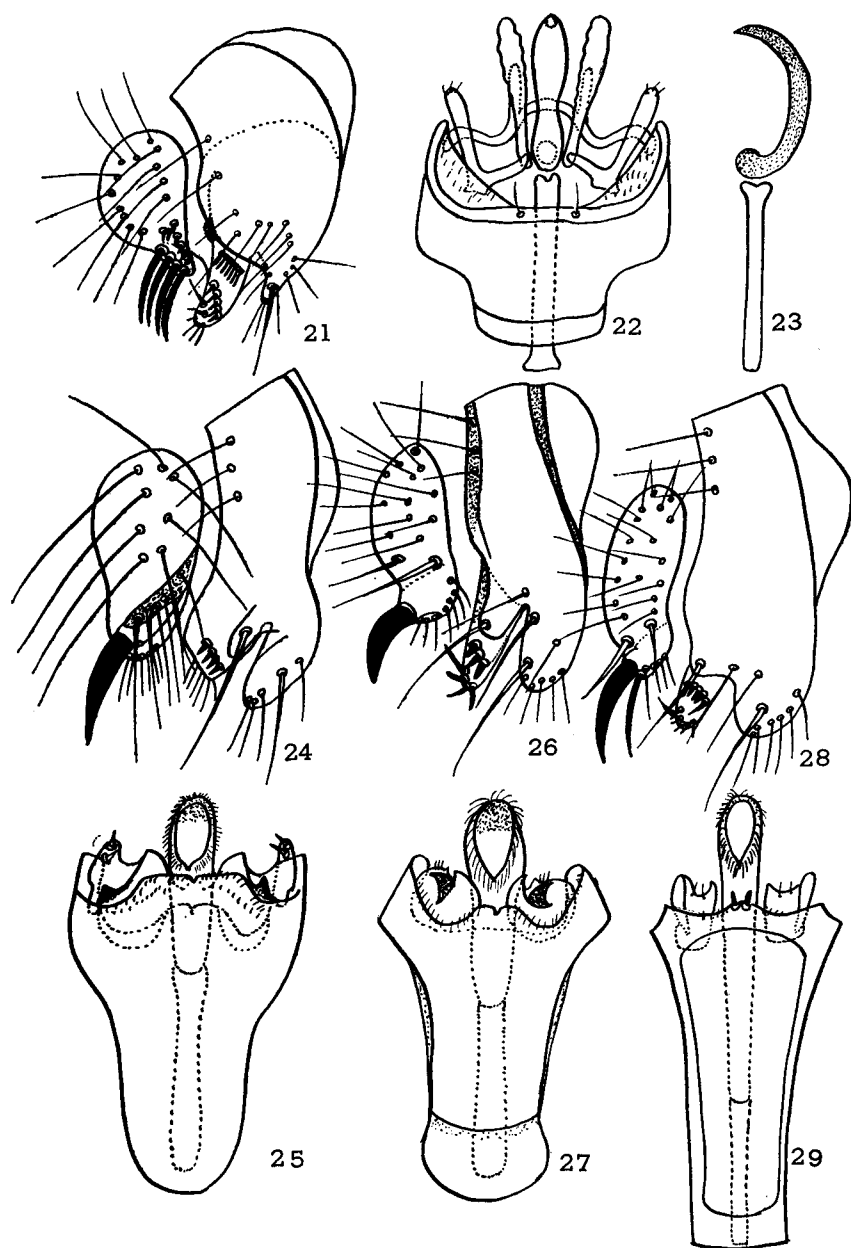
Holotype. Male, Silau Silau Trail, Mt. Kinabalu, December 12, 1972 (alcohol specimen by Shima).

Distribution. Mt. Kinabalu, Borneo.

***Drosophila flavopleuralis* Takada, Momma & Shima n. sp.**

(Text-figs. 24-25)

Male. Body about 2.2 mm in length, reddish yellow. Arista with 4 branches above, 3 below, besides a fork. Orbital bristles in the ratio 3:1:3. Oral bristles 2, equal in size. Palpi with a apical bristle, yellow. Carina flat. Acrostichal



Figs. 21-23. *Drosophila (Sophophora) longipectinata* n. sp., male genitalia. Figs. 24-25. *Drosophila (Sophophora) flavopleuralis* n. sp., male genitalia. Figs. 26-27. *Drosophila (Sophophora) nigropleuralis* n. sp., male genitalia. Figs. 28-29. *Drosophila (Sophophora) nigrialata* n. sp., male genitalia.

hairs in 6 rows. Anterior dorsocentral bristle about $1/2$ of posterior ones. Pleura slightly brownish yellow, humerals two, lower one longer. Halteres yellow. Sterno-index about 0.6.

Wings hyaline, Costal-index about 2.0; 4V-index about 2.5; 5x-index about 2.5; Ac-index about 3.0; C3-fringe on basal $4/9$. Sex-comb longitudinal along entire lengths of metatarsus and second tarsal segment; metatarsal comb consisting of about 35 very fine brown teeth, lowermost 2-3 somewhat larger; comb of second tarsal segment consisting of about 30 very fine brown teeth, tightly crammed together. Coxa with a few large bristles on apically. Abdominal tergites yellow with posterior brown bands.

Periphallic organs: Genital arch broad, toe low with about 5 bristles, protruding process partially covering base of clasper with a long bristle; heel rather pronounced. Primary clasper with a row of about 4 black teeth above and a cluster of 7-8 longer bristles below. Secondary clasper oval, attached to anal plate via membranous brown connection which has 5 long bristles; and with a very long black curved tooth, and 6 lower bristles. Anal plate conical, with about 8 large bristles.

Phallic organs: Aedeagus long, slender, apically hirsute. Anterior parameres large, concave, small lateral lobe with 2 fine sensilla, and with intermediate small process. Caudal margin of novasternum convex; without submedian spine. Phallosomal index about 1.0.

Holotype. Male, Silau Silau Trail, Mt. Kinabalu, June 28, 1972 (Takada).
Distribution. Mt. Kinabalu, Borneo.

***Drosophila nigropleuralis* Takada, Momma & Shima n. sp.**

(Text-figs. 26-27)

Male. Body about 2.0 mm in length, tannish yellow. Branches of arista are long, 4 above and 2 below, besides a large fork. Ocellars long. Orbital bristles in the ratio 7:2:7. Acrostichal hairs in 6 rows. Mesonotum shining tannish yellow, pleura dark brown. Anterior sternoplural bristle thin, sterno-index about 0.7. Abdominal tergites shining black or tannish brown with posterior broad dark bands. Legs tannish yellow, coxa with a few frontal hairs, femur swollen. Sex-comb longitudinal along entire lengths of metatarsus and second tarsal segment; metatarsal comb sinuate, consisting of about 35 black teeth, lower most a few teeth longer; comb of second tarsal segment consisting about 30 teeth.

Wings hyaline, costal-index about 2.0; 4V-index about 3.0; 5x-index about 4.0; Ac-index about 3.0; C3-fringe on basal $1/2$.

Periphallic organs: Genital arch broad dorsally and laterally, toe elliptical, with one long and about 5 small bristles; and with large triangular process at base of primary clasper. Primary clasper conical and slightly slender, with 5-6 large marginal teeth below and 3 stout teeth above. Secondary clasper with one big curved tooth and about 7 marginal teeth below. Anal plate oval, with about

13 long bristles and ventrolaterally one large bristle.

Phallic organs: Aedeagus long and slender, slightly bifid at apex, apically hirsute. Anterior paraneres circular, with large medial curved lobe and intermediate long process bearing 3 fine sensilla. Caudal margin of novasternum slightly convex with numerous marginal hairs. Submedian spine absent. Phallosomal index about 1.5.

Holotype. Male, Silau Silau Trail, Mt. Kinabalu, June 27, 1972 (Takada).

Paratypes. 5 males, collected together with holotype.

Distribution. Mt. Kinabalu, Borneo.

***Drosophila nigrialata* Takada, Momma & Shima n. sp.**

(Text-figs. 28-29)

Male. Body about 2.3 mm in length, dark reddish yellow. Arista with 4 branches above, 3 below, besides a large fork. Ocellars rather short. Orbital bristles in the ratio 5:2:6. Pulpi with only one prominent bristle. Acrostichal hairs in 6 rows. Anterior dorsocentral bristle about 0.6 of posterior ones. Posterior supraalar bristle long, equal in size to posterior ones. Pleura and scutellum dark brown. Legs dusky yellow. Coxa with many frontal long hairs. Sex-comb longitudinal along entire lengths of metatarsus and second tarsal segment; metatarsal comb consisting of about 50 very fine teeth, lower most one thicker, tightly crammed together; comb on second tarsal segment slightly sinuate, consisting of about 35 teeth.

Wings brownish tint, first costal section with 2 stout subequal bristles; Costal-index about 1.9; 4V-index about 3.0; 5x-index about 3.2; Ac-index about 3.0; C3-fringe on basal 3/5.

Periphallic organs: Genital arch black dorsally, toe broadly rounded with a long bristle and about 10 shorter bristles; medial process of genital arch small, covering base of primary clasper with a long bristle. Anal plate oval. Primary clasper small with a row of 4-5 curved pointed black teeth above and a cluster of 7-8 longer black teeth below, including one long tooth. Secondary clasper attached anal plate, with 2 large curved teeth, upper one very thick, lower one rather shorter and thinner, and with 5 marginal bristles.

Phallic organs: Aedeagus slender, very long, apically finely hirsute. Anterior parameres small and stiff, with 2 apical sensilla. Caudal margin of novasternum slightly convex at middle, with a pair of short and thick spines. Ventral fragma rectangular and slender. Phallosomal index about 1.8.

Holotype. Male, Kiau View Trail, Mt. Kinabalu, June 27, 1972 (Takada).

Paratypes. 2 males, collected together with holotype.

Relationships: It is quite interesting that the three species of *nigrialata*, *nigropleuralis* and *flavopleuralis* are morphologically very closed and all now known only from Mt. Kinabalu by male specimens.

***Drosophila palmata* Takada, Momma & Shima n. sp.**

(Text-figs. 30-32)

Male & female. Body about 2.5 mm in length, tannish yellow. Arista with 4 branches above, 3 below, besides a large fork. Front orange brown. Orbital bristles in the ratio 2:1:2. Second oral bristle about 2/3 of first ones. Palpi with only one apical bristle. Carina narrow and high. Mesonotum shining tannish yellow. Acrostichal hairs in 8 rows. Fore femur with about 10 long ventral bristles; fore tibia with long and stout preapical bristle present. Sex-comb longitudinal on the metatarsus and second tarsal segment; metatarsus comb consisting of about 12-15 uniform teeth; comb on second tarsal segment consisting of about 9-12 uniform teeth.

Wings upper half somewhat dusky; Costal-index about 2.5; 4V-index about 2.0; 5x-index about 2.3; Ac-index about 2.5; C3-fringe on basal 1/2. Tergites of male with caudal posterior black bands on 3rd and 4th, 5th and 6th tergites black. Tergites of female yellow with thin posterior dark bands.

Periphallic organs: Genital arch broad laterally; toe small, medial process of genital arch swollen with numerous bristles. Primary clasper elongated downward, with narrow process bearing 5 stout teeth; 2 large bristles present above and 6 small black teeth present towards top of clasper. Secondary clasper apparently represented by strongly sclerotized medial process fused to anal plate, with ventromedially directed finger-like process bearing apically one very large black tooth of almost uniform width, apically rounded; proximal portion of secondary clasper with about 8 stout bristles. Anal plate oval.

Phallic organs: Aedeagus long, strongly curved to ventrally, triangular dorsal process on apex, with sclerotized apical palm-like process on lateral both sides, bare. Basal apodeme of aedeagus rather short. Anterior parameres small, spherical, with minute apical sensilla. Posterior parameres brown, broad, 1/2 length of aedeagus. Ventral fragma broad but shallow, with a pair of small submedian spines, dorsolaterally protruded into large sword-like processes resembling posterior parameres. Phallosomal index about 2.0.

Holotype. Male, Silau Silau Trail, Mt. Kinabalu, June 27, 1972 (Takada).

Allotype. Female, collected together with holotype.

Paratypes. Many specimens collected by banana traps (Momma & Shima), June 27-29, December 11-14, 1972.

Relationships: Closely allied to *Drosophila rhopaloa* Bock & Wheeler from Thailand, in having periphallic organs, but distinguished from it in having P.I.2.0 (2.5 in *rhopaloa* from Mt. Kinabalu), clearly palm-like process on aedeagus (faintly sclerotized wing-like process in *rhopaloa* from Mt. Kinabalu) and small anterior parameres.

Distribution. Mt. Kinabalu (one of dominant species), Borneo.

***Drosophila penicillipennis* Takada, Momma & Shima n. sp.**

(Text-figs. 33-35)

Male & female. Body about 3.0 mm in length, tannish yellow. Arista 5 branches above, 3 below, besides a fork. Third antennae brown. Front orange brown, velvety. Periorbits dark brown. Orbital bristles in the ratio 4:2:5. Ocellars long. Carina high and narrow. Second oral bristle about 1/2 of first ones. Pulpi with only one stout bristle. Acrostichal hairs in 8 rows. Anterior dorsocentral bristles near posterior ones, about 1/2 length of latter. Humerals two, long, equal in size. Abdominal tergites with posterior bands. Sterno-index about 0.7. Coxa hirsute, fore femur swollen. Sex-comb longitudinal along entire lengths of metatarsus and second tarsal segment; metatarsal comb consisting of about 32 teeth, lower most 2 teeth longer; comb on second tarsal segment consisting about 13 long teeth.

Wings golden tint, first costal section with two stout bristles; Costal-index about 2.6; 4V-index about 2.2; 5x-index about 2.2; Ac-index about 2.5; C3-fringe on basal 1/2.

Periphallic organs: Genital arch broad with a constriction at anterior margin, toe pointed downward; posterior margin with a triangular process covering the upper part of primary clasper, with three large bristles. Primary clasper large; primary teeth about 15, secondary teeth stout, about 30 distributed all over the surface of clasper; inner surface with about 10 fine bristles. Secondary clasper conical with 2 stout curved black spines. Anal plate oval.

Phallic organs: Aedeagus hirsute, paintbrush-like, slender, with bifurcate hair-like process on dorsal part of aedeagus (figs. 34, 35). Anterior parameres large, articulated to aedeagus, with 3 apical sensilla. Apodeme of aedeagus with ventral rod. Posterior parameres horn-like, medially fused. Caudal margin of novasternum concave, with a pair of small submedian spines. Ventral fragma V shaped. Phallosomal index about 1.5.

Holotype. Male, Liwagu Cave, Mt. Kinabalu, June 28, 1972 (Takada).

Allotype. Female, collected together with holotype.

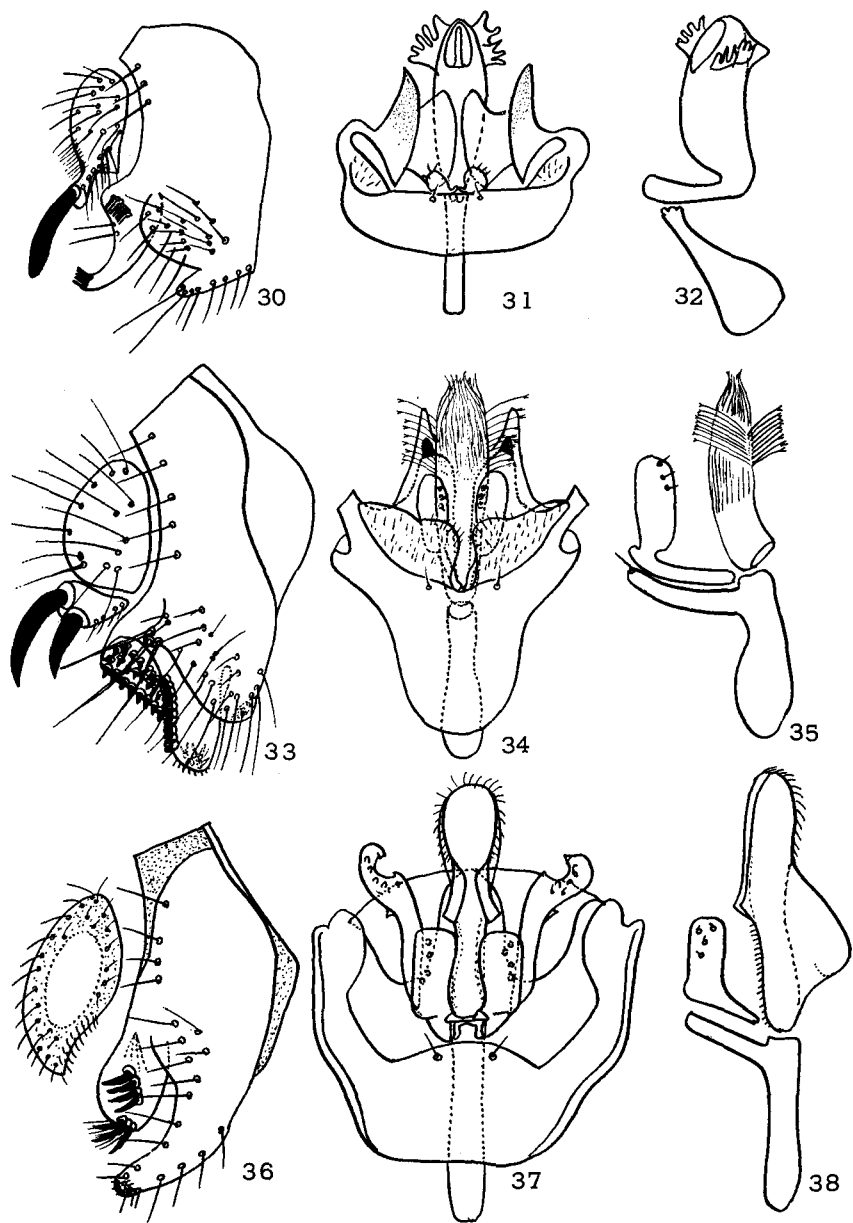
Paratypes. 2 males, collected together with holotype.

Distribution. Mt. Kinabalu, Borneo.

***Drosophila paraviaristata* Takada, Momma & Shima n. sp.**

(Text-figs. 36-38)

Male. Body about 2.5 mm in length, reddish yellow. Arista with very short 6 branches at apical half, 3 above, one below, including a terminal fork. Front orange brown. Orbital bristles in the ratio 5:2:7. First oral bristle long and straight. Pulpi with only one stout bristle. Acrostichal hairs in 8 rows. Sterno-index about 0.6. Coxa hirsute; fore femur swollen. Sex-comb longitudinal along over lengths of metatarsus, consisting of about 35 teeth, sinuate, lower half



Figs. 30–32. *Drosophila* (*Sophophora*) *palmata* n. sp., male genitalia. Figs. 33–35. *Drosophila* (*Sophophora*) *penicillipennis* n. sp., male genitalia. Figs. 36–38. *Drosophila* (*Sophophora*) *paraviaristata* n. sp., male genitalia.

teeth longer. Thrid to sixth tergites black. Posterior scutellars large.

Wings hayline, Costal-index about 4.0; Ac-index about 2.0; C3-fringe on basal 1/2.

Periphallic organs: Genital arch broad laterally, constricted dorsally. Toe elongate, narrow, with about 8 bristles and several apical sensilla. Primary clasper only present, broad, with a comb of about 4-5 strong black teeth dorsolaterally, a similar comb of about 3 long teeth ventrolaterally, a ventromedial cluster of bristles. Anal plate large, fig shaped, central portion transparent; with short bristles on undermargin.

Phallic organs: Aedeagus slender with dorsal fin-like process, apically rounded and with hairs. Anterior parameres large, rectangular, with apical sensilla, articulated to aedeagus. Apodeme of aedeagus with a ventral rod. Posterior parameres large, apically curved with several warts, and apex hook-like. Caudal margin of novasternum slightly concave, with a pair of submedian spines. Ventral fragma shallow. Phallosomal index about 1.3.

Holotype. Male, Liwagu Cave, Mt. Kinabalu, June 28, 1972 (Takada).

Paratypes. 3 males, collected together with holotype.

Distribution. Mt. Kinabalu, Borneo.

***Drosophila pseudobaimai* Takada, Momma & Shima n. sp.**

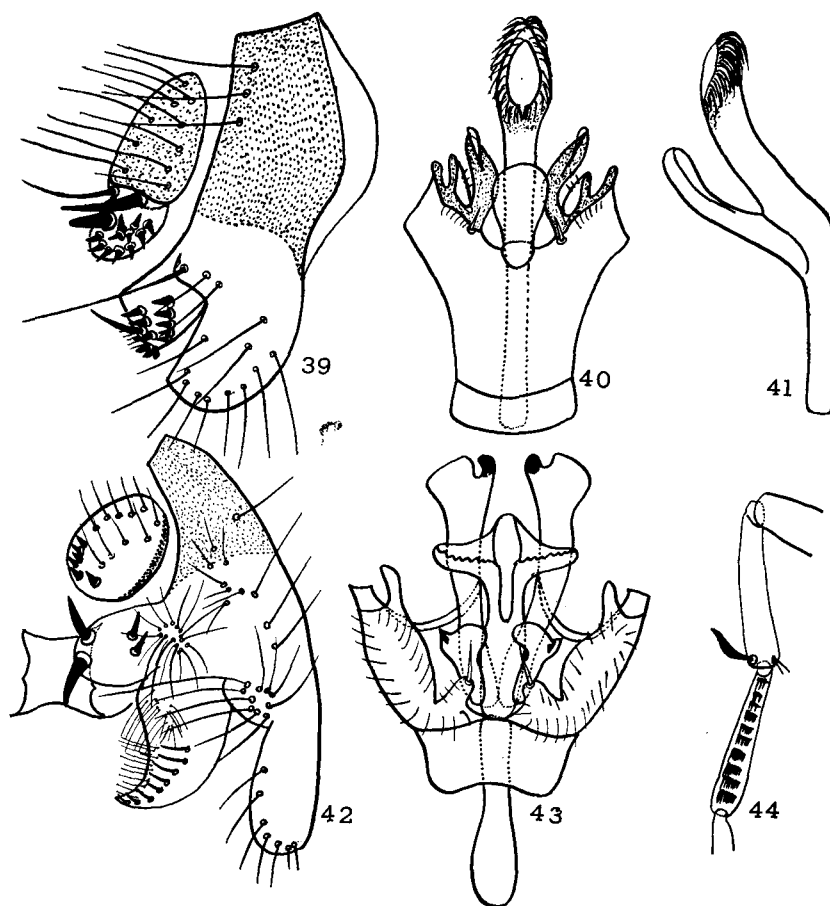
(Text-figs. 39-41)

Male. Body about 2.0-2.3 mm in length, yellow or reddish yellow. Arista with 4-5 branches above, 3 below, besides a terminal fork. Orbital bristles in the ratio 3:1:4. Second oral bristle about 1/2 length of first ones, thin. Palpi with only one prominent bristle. Acrostichal hairs in 6 rows. Sterno-index about 0.4. Sex-comb longitudinal along entire lengths of metatarsus and second tarsal segment; metatarsal comb consisting of about 20 teeth, lower most 2 displaced from axis of remaining teeth; comb on second tarsal segment consisting of about 16 uniform teeth, rather smaller than metatarsal comb.

Wings hyaline, Costal-index about 2.4; 4V-index about 3.0; 5x-index about 3.0; Ac-index about 3.0; C3-fringe on basal 5/9. Second to fifth tergites with distinct posterior black bands, sixth tergite with black band at dorsally.

Periphallic organs: Genital arch dark brown dorsally, broad dorsally and laterally, with small triangular process at base of primary clasper, toe right angle with about 10 bristles. Primary clasper 4 large marginal teeth above, a cluster of about 9 marginal teeth (one larger than the other) below, and 5 strong teeth dorso-laterally. Secondary clasper almost conical, with a cluster of about 11 pointed teeth and one big stout tooth. Anal plate dark brown, oval, with about 16 long bristles and ventrolaterally one large black tooth.

Phallic organs: Aedeagus long and slender, apically hirsute, slightly pointed at tip, with large broader hollow process, ventrally. Anterior parameres very large, brown, with large medial lobe, small lateral lobe, and intermediate processes



Figs. 39-41. *Drosophila (Sophophora) pseudobaimaii* n. sp., male genitalia. Figs. 42-44. *Drosophila (Sophophora) pereirai* n. sp., male genitalia and fore leg.

bearing 3 fine sensilla. Caudal margin of novasternum concave, with a pair of widely separated submedian spines. Phallosomal index about 1.0.

Holotype. Male, Silau Silau Trail, Mt. Kinabalu, December 12, 1972 (alcohol specimen by Shima).

Paratypes. 2 males, collected together with holotype.

Distribution. Mt. Kinabalu, Borneo.

Relationships: Closely related *Drosophila baimaii* Bock & Wheeler from Malaya and Thailand, in having male genitalia but differs from it in having large wing indicies, a big tooth on secondary clasper, right angle toe and apically hirsute of aedeagus (apically bare and subapically hirsute in *baimaii*).

***Drosophila pereirai* Takada, Momma & Shima n. sp.**

(Text-figs. 42-44)

Male. Body about 3.0 mm in length, tannish yellow. Arista with 3 branches above, 2 below, besides terminal fork. Orbital bristles in the ratio 4:1:4. Second oral bristle about 1/2 length of first ones. Acrostichal hairs in 8 rows. Lower humerals longer than upper ones. Anterior dorsocentral bristles small, about 2/7 length of posterior ones. Sterno-index about 0.6. Preapical bristle of fore tibiae large and tape-like, pointed at tip. Sex-comb of metatarsus in transverse 10 rows of stout black teeth; about 3:3:3:5:5:5:10:10:10 and 10 (from above down).

Wings hyaline with tip of R4+5 vein (3rd longitudinal vein) clouded; Costal-index about 2.4; 4V-index about 1.9; 5x-index about 2.0; Ac-index about 2.5; C3-fringe on basal 2/5. First to third tergites yellow; fourth tergite darkbrown, laterally yellow; fifth and sixth tergites dark brown.

Periphallic organs: Genital arch broad and long, lower portion bag-like, with 7 bristles; upper portion with 10 bristles and middle portion with about 6 long and 5 short bristles present. Primary clasper elongated downward, with about 10 primary teeth and numerous yellowish hairs at ventrally. Secondary clasper fused at middle of posterior margin of genital arch; two divergent large black teeth on posterior margin and two short black teeth at anterior portion; and the base of secondary clasper with a cluster of yellowish hairs. Anal plate oval, with about 10 bristles, ventral portion with about 6 thick short teeth.

Phallic organs: Aedeagus laterally compressed, distally broadened and divided into two lobes, marginally serrate with notch. Anterior parameres large, globular, lateral apex pointed, without sensillum. Posterior parameres very large, laterally compressed, flat; heavy sclerotized thumb-like process at tip. Novasternum hirsute, a pair of submedian spines separate on the protruded portions. Ventral fragma shallow. Phallosomal index about 0.7.

Holotype. Male, Liwagu Cave, Mt. Kinabalu, June 28, 1972 (Takada).

Distribution. Mt. Kinabalu, Borneo.

Subgenus ***Drosophila*** Fallén

Drosophila Fallén, 1823: 4.

Type-species: *Musca funebris* Fabricius, 1787: 345.

immigrans group Sturtevant***immigrans*** subgroup Wilson *et al.*¹⁾***Drosophila ustulata*** de Meijere

Drosophila ustulata de Meijere, 1908. Tijds. v. Ent. 51: 157 (Java).

(Text-figs. 45-47, 52)

Male & female. Body about 3.5 mm in length reddish yellow. Arista 7

1) Wilson, Wheeler, Harget & Kambyssellis, 1969. Univ. Tex. Publ. 6918: 211.

branches above, 3 below, besides a terminal fork. Orbital bristles in the ratio 3:2:4. Oral bristles 2, long, equal in size. Pulpi with a few prominent bristles. Acrostichal hairs in 8 rows. Sterno-index about 0.7.

Fore legs of male (fig. 52): tibiae with 4 long curly apical bristles on outer surface; metatarsus with 2 stout spines located apicolaterally and basally separate each other, also with about 6 long curly hairs arranged longitudinal row on outer surface.

Wings of male: wings golden tint and with large apical cloud and posterior crossvein clouded; Costal-index about 4.7; 4V-index about 1.3; 5x-index about 1.0; Ac-index about 1.4; C3-fringe on basal 1/2. Wings of female without such large apical cloud.

Tergites of male: 4th tergite with dorsal black band and laterally yellow, 5th to 6th tergites black or pale brown.

Tergites of female: 2nd to 3rd tergites with dorsal posterior bands interrupted at middle; the other tergites yellow.

Periphallic organs: Genital arch slender with 6 long bristles at lower posterior margin; toe truncate with 2 stout bristles. Primary clasper large and crescent, with about 10 primary teeth and about 7 long stout marginal bristles; clasper connected to genital arch by bar-like process at upper portion. Anal plate large, cocoon-shaped, with many long hairs; tip pointed with 3 stout spines.

Phallic organs: Ventral fragma large, V-shaped, as length as aedeagus plus apodeme. Aedeagus large, subapically with an elongated, forked and caudally dorsal appendage; medially with a dorsal fin-like process; apically flattened and rounded. Ventral rod of aedeagus present. Anterior parameres attached to the lateral corners of novasternum with 2 sensilla; submedian spines present. Phallosomal index about 2.0.

Specimens examined: Many specimens, Silau Silau Trail, Mt. Kinabalu, June 27-29, 1972 (Momma & Takada); Dec. 11-14, 1972 (Momma & Shima).

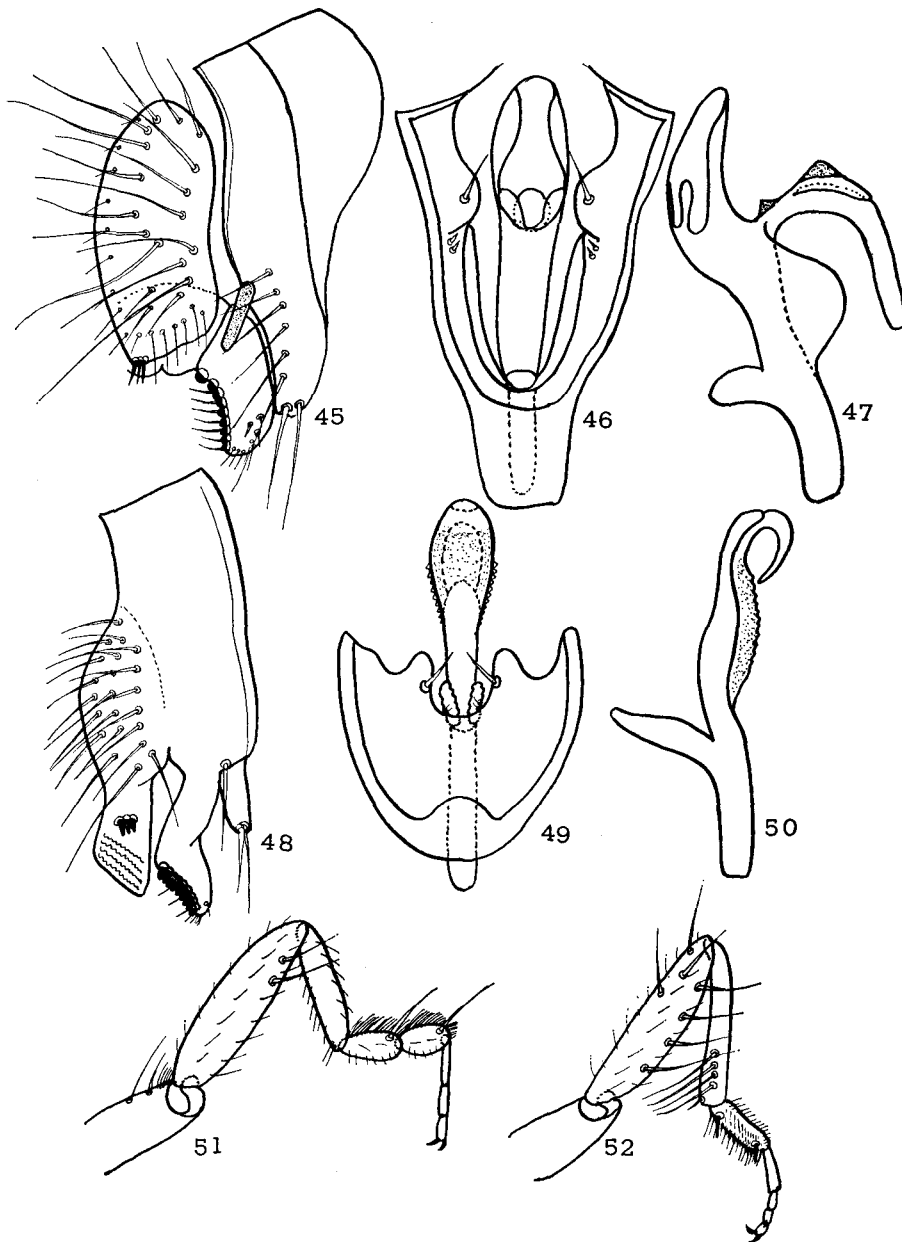
Distribution. Java, Borneo (new record).

Relationships: A dimorphic species of the immigrans subgroup, and one of dominant drosophilid fly in Mt. Kinabalu.

***Drosophila parasignata* Takada, Momma & Shima n. sp.**

(Text-figs. 48-51)

Male. Body about 4.0-4.5 mm in length, yellow. Head flat, reddish yellow. Arista 7-8 branches above, 4 below, besides a terminal fork. Second antennae with 3 spines, upper one larger. Second oral bristle long, equal in size of first ones. Cheeks about 1/9 as broad as the greatest diameter of eye. Palpi with one apical black bristle. Acrostichal hairs in 10 rows. Humeral bristles, two, large. Second to sixth tergites with distinct posterior black bands. Sterno-index about 0.6. Fore legs (fig. 51); a row of about 15 black spines on lower apical part of femur. Metatarsus and second tarsal segments swollen, with many golden brown



Figs. 45-47 & 52. *Drosophila (Drosophila) ustulata* de Meijere, male genitalia and fore leg. Figs. 48-51. *Drosophila (Drosophila) parassignata* n. sp., male genitalia and fore leg.

hairs on inner surface and with one long black bristle each apically; third to fifth segment of tarsus connected right angle at subterminal of second segment.

Wings slightly fuscous, crossveins clouded, first costal section with 2 stout bristles; Costal-index about 2.6; 4V-index 1.4; 5x-index about 1.0; Ac-index about 2.5; C3-fringe on basal 9/10.

Periphallic organs: Genital arch, black, heavy sclerotized and completely fused to anal plate; heel present with one stout bristle; toe connected to heel, triangular, with 2 stout bristles. Anal plate with about 25 bristles and with secondary clasper. Secondary clasper rectangular with 3 yellowish spines at ventrolaterally, lower portion with 5 rows of serration. Primary clasper elongated downward with about 9 primary teeth.

Phallic organs: Aedeagus club shaped, long, serrated dorsal half and with lash-like process at apicoventrally. Anterior parameres small with a few sensilla at basally. Ventral fragma triangular with deep median notch and 2 stout submedian spines. Phallosomal index about 1.5.

Holotype. Male, Silau Silau Trail, Mt. Kinabalu, Dec. 12, 1972 (alcohol specimen by Shima).

Paratype. Male, collected together with holotype.

Distribution. Mt. Kinabalu, Borneo.

nasuta subgroup Wilson *et al.*

Drosophila sulfurigaster Duda

Drosophila sulfurigaster Duda, 1923. Ann. Mus. Nat. Hung., 20: 59 (New Guinea).; Wilson *et al.* 1969. Univ. Tex. Publ. 6918: 217.

Specimens examined: 2 males, Silau Silau Trail, Mt. Kinabalu, June 27, 1972 (Takada).

Distribution. New Guinea, Hawaii, Polynesia, Guam, Borneo (new record).

Drosophila kohkoa Wheeler

Drosophila kohkoa Wheeler, in Wilson *et al.* 1969. Univ. Tex. Publ. 6919: 217 (Cambodia).

Specimens examined: 4 males, Silau Silau Trail, Mt. Kinabalu, June 28, 1972 (alcohol specimens by Momma).

Distribution. South-Eastern Asia wide.

hypocausta subgroup Wilson *et al.*

Drosophila pararubida Mather

Drosophila pararubida Mather, 1961. Univ. Queensland Papers, 1: 255 (New Guinea); Mather, 1968. Univ. Queensland Papers, 3: 49.

Specimens examined: Many specimens, Headquarters Cabins, June 27-30; Dec. 11-14, 1972 (Momma, Shima & Takada).